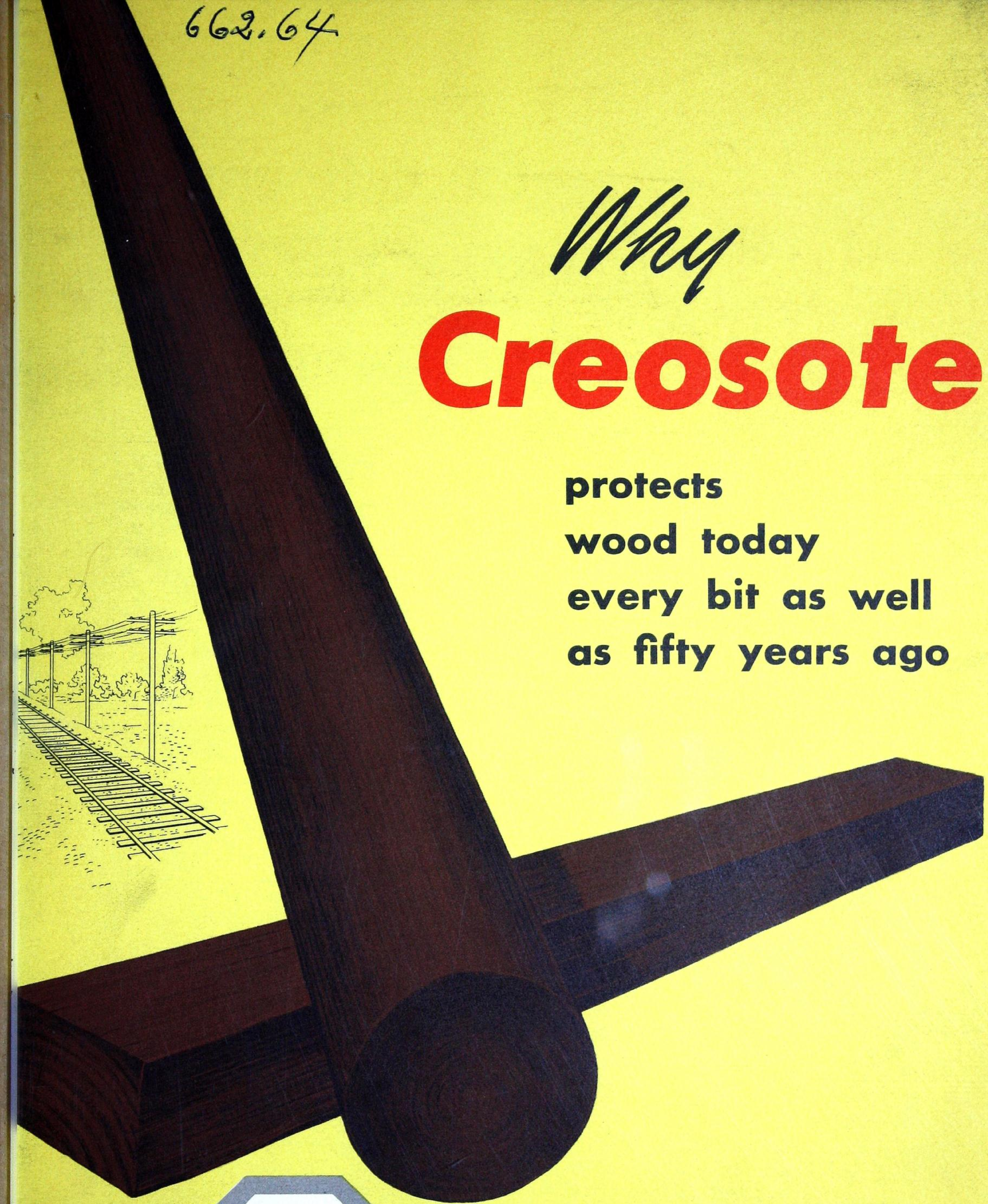
662.64

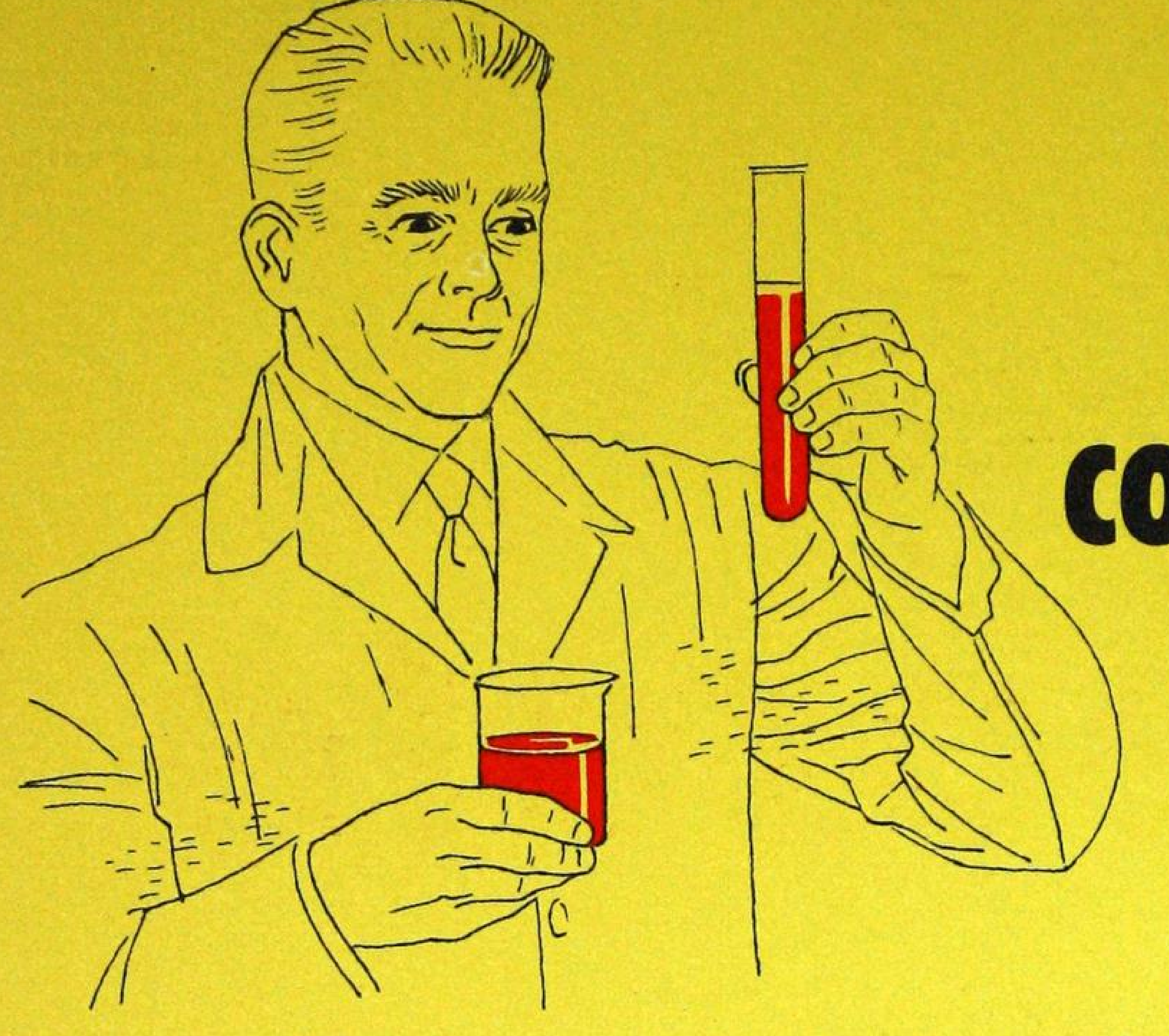


Why Creosote

protects wood today every bit as well as fifty years ago

KOPPERS COMPANY, INC.
TAR PRODUCTS DIVISION
PITTSBURGH 19, PA.

1952, Koppers Company, Inc



Creosote produced b contains all of the woo that creosote possesse

TESTS ON NUMEROUS COMPOUNDS SELECTED FROM THE MOST PREVALENT OF THE 162 IN CREOSOTE HAVE SHOWN THAT *ALL* ARE TOXIC TO FUNGI AND TERMITES

The power of creosote to preserve wood so well does not rest on any *one* of its 162 components . . . but rather is due to the *many* toxic compounds it contains. It has been proved by recognized authorities testing over fifty selected compounds (which make up a large percentage of creosote) that all are toxic to the major wood-rotting fungi and termites. These tested compounds cover almost the entire distillation range of creosote from 175°C. to 393°C. and are characteristic of all elements found within that range.

EACH TOXIC COMPOUND IN CREOSOTE IS MOST EFFECTIVE IN PROTECTING WOOD WHEN USED IN CONJUNCTION WITH THE OTHERS

In Forest Products Laboratory tests, it was shown that while a single pure creosote compound in itself was definitely toxic to fungi, when two such compounds were mixed, the effect on the fungus was far greater than that of either compound alone. This fact is extremely important when it is considered that all the compounds in creosote are toxic to fungi.

Throughout this text we have used charts and data on fungi to illustrate as simply as possible the facts relative to the composition of creosote and its toxicity. Equally strong data can be furnished with regard to wood destroying insects and marine borers. Creosote is without question, the most satisfactory protection for wood!

Koppers Company today preserving chemicals fifty years ago

ALL OF THE *IMPORTANT* CHEMICAL COMPOUNDS TOXIC TO FUNGI, TERMITES AND MARINE BORERS ARE RETAINED IN CREOSOTE TODAY

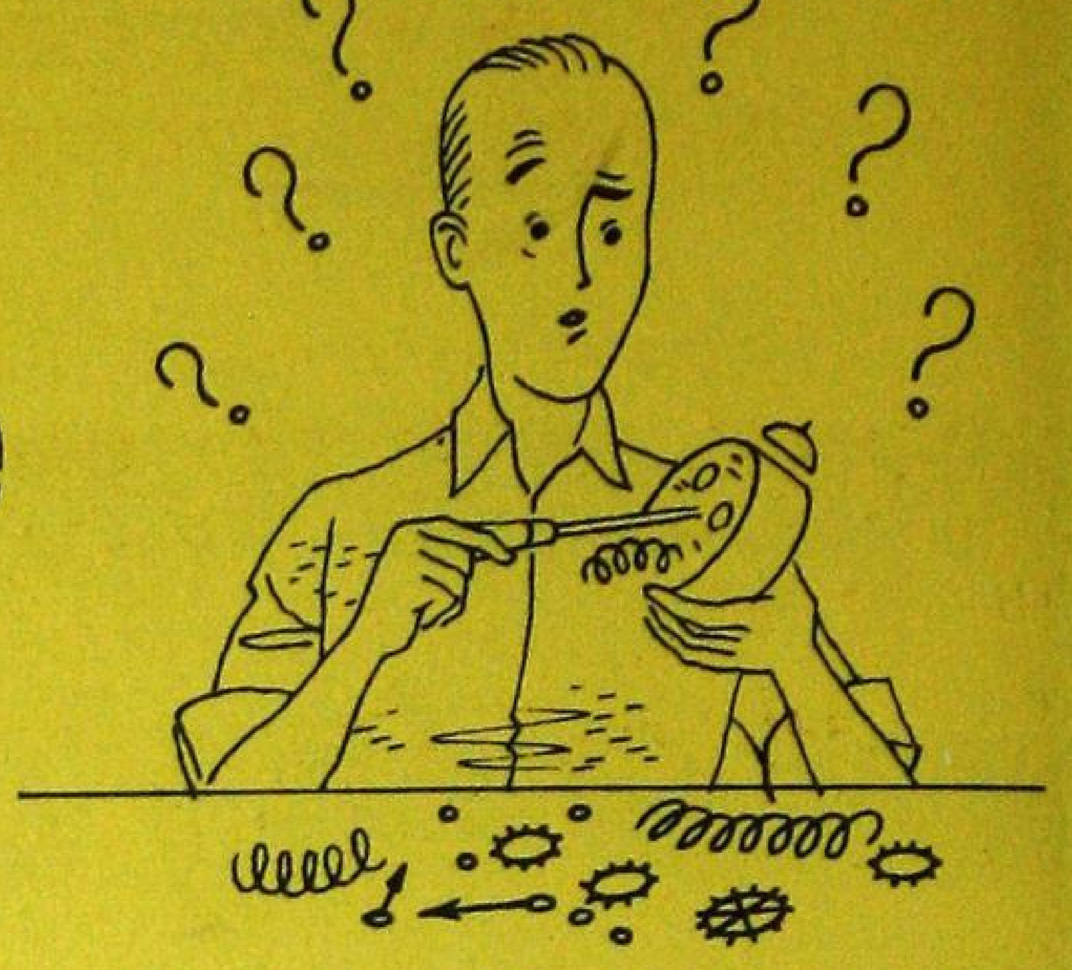
Creosote must meet the high standards of The American Wood Preservers' Association, American Railway Engineering Association, The Rural Electrification Administration and other Federal specifications. No wood-preservative chemicals of importance are taken from Creosote today that were not removed by processing years ago.

Essentially, then, today's coal tar creosote that meets rigid industry standards has the full wood preservative powers that it had years ago.

YOU CAN SPECIFY CREOSOTE FOR WOOD PROTECTION, KNOWING THAT IT IS STILL THE *MOST EFFECTIVE* WOOD PRESERVING AGENT

There are indications that fungi, molds, insects and other organisms might eventually adapt themselves to *any single* toxic agent used as a wood preservative. BUT THEY CAN NOT ADAPT THEMSELVES TO THE MULTIPLICITY OF TOXIC COMPOUNDS IN CREOSOTE. Therefore, you don't need to *guess* about the preservative power of creosote — just be certain that it *is* coal tar creosote — and then use plenty of it!

Let's dig more deeply into the chemistry of creosote to see what makes it "tick"



TO BEGIN WITH . . . JUST WHAT IS THIS SUBSTANCE CALLED CREOSOTE?

Creosote is a bulk distillate of coal tar. Distillation is accomplished by applying heat to coal tar in a still. Usually creosote begins to distill out at 175-200°C. and ends about 400-450°C. Commercial creosote today must conform to the standards of AWPA, AREA, the REA and other Federal specifications regarding origin, distilling range, specific gravity, residue, water content and similar requirements.

There are 162 known chemical compounds in creosote (see pages 6-7), but all are not present in equal proportions. Twenty-five to thirty compounds account for nearly half the bulk of creosote.

HOW WAS CREOSOTE PRODUCED IN THE EARLY DAYS OF TAR DISTILLATION?

In the early days of tar distillation in this country, the main business of the tar distiller was the making of roofing pitch. The distillate that was recovered during this process was creosote. This was not always Grade One creosote because it often contained a high percentage of the more volatile material.

Further refinement and improvement in quality was accomplished by keeping separate the more volatile material below 235°C. This cut was known as "insecticide oil" because it was sold at the time for making sheep and cattle dip. "Insecticide oil" was made up mostly of phenol, cresols, xylenols, naphthalene and tar bases. At times, anthracene cake was also produced and sold to dye manufacturers for production of vat type dyes.

WHAT IS THE PRACTICE IN THE DISTILLATION OF CREOSOTE TODAY?

Approximately the same procedure is followed by the tar distiller today. The "insecticide oil" cut is taken the same as it was years ago. Then the wide-boiling creosote fraction is taken (from which nothing is extracted) and there remains behind — coal tar pitch. Modern tar distillers often treat the insecticide oil by washing, chilling, further distillation, etc., to break it down into the components mentioned above for sale as pure compounds. Removal of the "insecticide oil" is seldom complete — but "commercial" only.

WHICH CHEMICALS ARE REMOVED FROM CREOSOTE TODAY AS COMPARED WITH YEARS AGO?

The best comparison of the chemicals removed from creosote today with those distilled off years ago can be found in the chart on pages 6 and 7. A study of this will show that there are no chemicals removed today (except in small experimental quantities) that were not removed 30 years ago as the "insecticide oil" distillate.

Thus, *creosote today is basically unchanged* from that which was produced years ago. It follows, therefore, that *if the chemical compounds of creosote are the same . . . the wood preservation qualities must be the same.*

HOW CAN WE PROVE THAT CREOSOTE IS TOXIC TO FUNGI AND TERMITES?

We have said that the wood preservative power of creosote does not lie with any *one* of its components and that it is the *very multiplicity of compounds* that make it so effective. Proof of this is found in the table below. This chart shows the results of tests on twenty-seven selected creosote compounds. All were found toxic to three of the major wood destroying fungi when tested individually, although all were not toxic in the same degree. Note that the tests made on the creosote fractions which contain several of these compounds, show much greater toxicity than the individual components.

A careful check over the chart of pages 6 and 7 will show that of the twenty-seven tested fungi-toxic compounds shown in the chart below, most are invariably found in commercial creosote today (and probably all twenty-seven, since recovery is only commercial, not complete). Thus, CREOSOTE HAS LOST NONE OF ITS WOOD PRESERVATIVE VALUE IN THE PAST HALF CENTURY!

Furthermore, these tests proved that, while each pure compound in itself was toxic to fungi, when the compounds were combined, the toxicity of the mixture was far greater than that of the individual compounds alone. When it is considered that there are over 160 compounds in creosote, the implications are tremendous!

The true value of creosote as a wood preservative lies in the *very multiplicity of toxic compounds it contains.* Fungi, termites and other wood destroying organisms just don't have a chance to adapt themselves to its many toxic agents and survive!

PRESERVATIVE VALUE OF CREOSOTE COMPOUNDS AND CREOSOTE FRACTIONS

(European agar-wood block method) Reference: Schulze and Becker*

Material Tested	Chemical Formula	Type[1]	Boiling Point °C.	Melting Point °C.	Density	Preservative Value Against Fungi Limit Values — Lb. per Cu. Ft.		
						Con. cerebella	*Poria vaporaria*	*Len. lepideus*
Whole Creosote	....	......	......	......	....	0.32–0.42	0.35–0.41	1.53–1.83
Fraction — 180°-200°C	....	......	......	......	....	0.34–0.49	0.52–0.84	0.53–0.78
200°-220°C	....	......	......	......	....	0.24–0.38	0.38–0.50	0.50–0.81
220°-240°C	....	......	......	......	....	0.51–0.79	0.40–0.55	0.81–1.10
240°-260°C	....	......	......	......	....	0.71–0.98	0.51–0.81	1.18–1.81
260°-280°C	....	......	......	......	....	0.38–0.52	0.55–0.82	1.28–2.00
280°-300°C	....	......	......	......	....	0.24–0.36	0.42–0.55	1.37–2.00
300°-330°C	....	......	......	......	....	0.24–0.38	0.77–1.07	1.28–1.91
330°-360°C	....	......	......	......	....	0.49–0.75	1.10–1.28	0.71–0.97
Residue	....	......	......	......	....	....	4.97–10.1	4.91–10.1
Phenol	C_6H_6O	TA	181	41	1.005–45°	0.29–0.40	1.69–2.15	<0.008
Aniline	C_6H_7N	TB	184	− 6	1.02	6.1–9.9	2.93–6.10	....
Benzonitrile	C_7H_5N	NN	191	−13	1.005	0.76–0.80	1.93–3.50	1.93–3.50
Cresol — Ortho	$C_7H_8O_3$	TA	191	31	1.048	0.56–0.84	0.32–0.47	0.47–0.62
Cresol — Meta	$C_7H_8O_3$	TA	202	11	1.034			
Cresol — Para	$C_7H_8O_3$	TA	202	34	1.035			
Acetophenone	C_8H_8O	NO	202	20	1.030	1.10–1.40	0.80–1.10	1.34–2.80
Naphthalene	$C_{10}H_8$	H	218	80	1.17	0.19–0.26	0.27–0.43	1.28–2.50
Thionaphthene	C_8H_6S	S	227	32	1.148–36°	0.21–0.29	0.45–0.69	0.51–0.67
Quinoline	C_9H_7N	TB	238	−15	1.093	0.29–0.40	2.81–5.60	0.57–0.80
Isoquinoline	C_9H_7N	TB	242	25	1.098	0.47–0.73	0.38–0.47	0.80–1.07
Methylnaphthalene (beta)	$C_{11}H_{10}$	H	242	34	1.029?	0.43–0.55	0.57–0.92	1.15–1.37
Methylnaphthalene (alpha)	$C_{11}H_{10}$	H	243	−22	1.000?	0.32–0.47	0.85–1.28	0.60–1.10
Quinaldine	$C_{10}H_9N$	TB	248	− 2	1.059	0.55–0.86	2.81–4.68	0.97–1.15
Diphenyl	$C_{12}H_{10}$	H	255	70	....	0.58–0.86	>6.6	>6.5
2, 6-Dimethylnaphthalene	$C_{12}H_{12}$	H	262	110–111	1.008?	3.62–4.76	>4.80	>4.87
Acenaphthene	$C_{12}H_{10}$	H	278	95	1.06	1.31–1.94	2.50–4.74	>1.92
Alpha-naphthol	$C_{10}H_8O$	TA	280	96	1.224	0.75–1.01	0.09–0.14	0.36–0.49
Beta-naphthol	$C_{10}H_8O$	TA	286	123	1.217	0.26–0.36	0.11–1.82	0.24–0.37
Diphenylene-oxide	$C_{12}H_8O$	NO	287	85	....	1.41–2.15	2.87–5.87	>5.87
Fluorene	$C_{13}H_{10}$	H	294	115	....	0.94–1.37	2.15–3.13	>7.99
Phenanthrene	$C_{14}H_{10}$	H	340	100	1.063–101°	0.48–0.99	2.43–3.51	4.61–8.74
Anthracene	$C_{14}H_{10}$	H	340	217	1.242	>0.87	>0.87	>0.87
Acridine	$C_{13}H_9N$	TB	346	110	....	....	<0.75	<0.76
Carbazole	$C_{12}H_9N$	TB	352	238	....	>2.18	>4.02	>4.02
Fluoranthene	$C_{15}H_{10}$	H	382	109	....	>5.92	>5.36	>5.36
Pyrene	$C_{16}H_{10}$	H	393	149–150	....	3.93–5.42	>5.90	3.00–4.06

> More than.

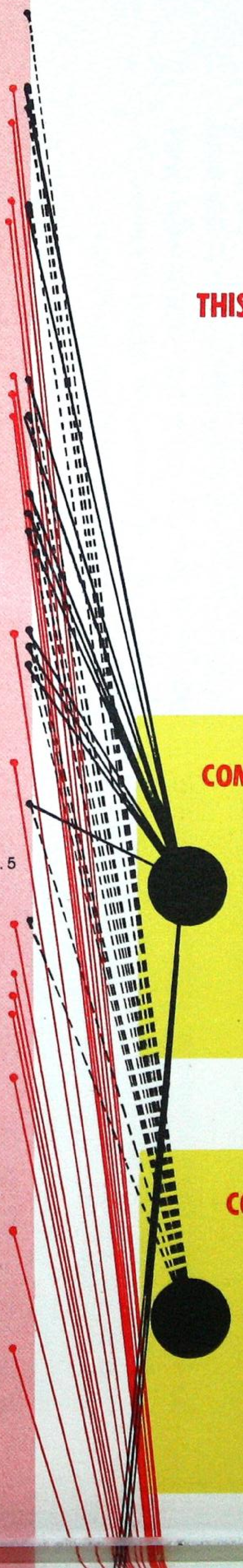
< Less than.

[1] TA — Tar acid, TB — Tar base (amine), NN — Neutral nitrogen compound, NO — Neutral oxygen compound, H — Neutral hydrocarbon, S — Sulphur compound.

*Schulze, Von Bruno, and Becker, Gunther, "Untersuchungen uber die pilzwidrige und insektentotende Wirkung von Fraktionen und Einzelstoffen des Steinkohlenteerols," Holzforschung, Berlin 2, Band 1948, Heft 4, pp. 97-128.

STRAIGHT RUN CREOSOTE DISTILLATION RANGE

	COMPOUND	FORMULA	BOIL. PT
1.	Coumarone	C_8H_6O	173–175
2.	1, 2, 3-Trimethylbenzene	C_9H_{12}	176.1
3.	Cymene	$C_{10}H_{14}$	177
4.	Hydrindene	C_9H_{10}	178
5.	**Phenol**	C_6H_6O	**181**
6.	Indene	C_9H_8	182
7.	**Aniline**	C_6H_7N	**184**
8.	3, 4-Dimethylethylbenzene	$C_{10}H_{14}$	189
9.	Ammonium thiocyanate	NH_4SCN	d. 190
10.	6-Methylcoumarone	C_9H_8O	190–191
11.	**0-Cresol**	C_7H_8O	**190–191**
12.	**Benzonitrile**	C_7H_5N	**191**
13.	3 or 5-Methylcoumarone	C_9H_8O	195–196
14.	n-Undecane	$C_{11}H_{24}$	195.8
15.	Durene (1, 2, 4, 5-tetramethylbenzene)	$C_{10}H_{14}$	196
16.	4-Methylcoumarone	C_9H_8O	197–199
17.	Isodurene (1, 2, 3, 5-tetramethylbenzene)	$C_{10}H_{14}$	198
18.	p-Toluidine	C_7H_9N	200.4
19.	o-Toluidine	C_7H_9N	200.7
20.	**p-Cresol**	C_7H_8O	**201**
21.	**Acetophenone**	C_8H_8O	**202**
22.	**m-Cresol**	C_7H_8O	**202**
23.	m-Toluidine	C_7H_9N	203.3
24.	4-Methylindene	$C_{10}H_{10}$	205
25.	Tetrahydronaphthalene	$C_{10}H_{12}$	206.8
26.	2, 4-Xylenol	$C_8H_{10}O$	209
27.	2, 6-Xylenol	$C_8H_{10}O$	211.2
28.	2, 5-Xylenol	$C_8H_{10}O$	211.5
29.	2, 4-Xylidine	$C_8H_{11}N$	212
30.	m-Ethylphenol	$C_8H_{10}O$	214
31.	2, 5-Xylidine	$C_8H_{11}N$	215
32.	p-Ethylphenol	$C_8H_{10}O$	218
33.	**Naphthalene**	$C_{10}H_8$	**218**
34.	2, 3-Xylenol	$C_8H_{10}O$	218
35.	3, 5-Xylenol	$C_8H_{10}O$	219.5
36.	3, 5-Xylidine	$C_8H_{11}N$	220–221
37.	3, 6-Dimethylcoumarone	$C_{10}H_{10}O$	220–222
38.	4, 5-Dimethylcoumarone	$C_{10}H_{10}O$	220–222
39.	4, 6-Dimethylcoumarone	$C_{10}H_{10}O$	220–222
40.	**Thionaphthene**	C_8H_6S	**222**
41.	2, 3-Xylidine	$C_8H_{11}N$	223
42.	3, 4-Xylenol	$C_8H_{10}O$	225
43.	Dimethylindene	$C_{11}H_{12}$	225–230
44.	Pseudocumenol (2, 4, 5-trimethylphenol)	$C_9H_{12}O$	232
45.	3-Ethyl-5-methylphenol	$C_9H_{12}O$	232.5–234.5
46.	2, 3, 4, 5-Tetramethylpyridine	$C_9H_{13}N$	233
47.	Isopseudocumenol (2, 3, 5-trimethylphenol)	$C_9H_{12}O$	233
48.	**Quinoline (leucoline)**	C_9H_7N	**238**
49.	7-Hydroxycoumarone	$C_8H_6O_2$	240
50.	Methylthionaphthene	C_9H_8S	240–245
51.	**2-Methylnaphthalene**	$C_{11}H_{10}$	**241.14**
52.	**Isoquinoline**	C_9H_7N	**243.25**
53.	**1-Methylnaphthalene**	$C_{11}H_{10}$	**244.78**
54.	4-Hydroxyhydrindene	$C_9H_{10}O$	245
55.	2-Methylquinoline	$C_{10}H_9N$	247.60
56.	**8-Methylquinoline**	$C_{10}H_9N$	**247.75**
57.	3, 4, 5-Trimethylphenol	$C_9H_{12}O$	248
58.	Durenol (2, 3, 5, 6-tetramethylphenol)	$C_{10}H_{14}O$	248
59.	Benzoic acid	$C_7H_6O_2$	249
60.	5-Hydroxyhydrindene	$C_9H_{10}O$	251
61.	2-Ethylnaphthalene	$C_{12}H_{12}$	252
62.	3-Methylisoquinoline	$C_{10}H_9N$	252.25
63.	Indole	C_8H_7N	253
64.	**Diphenyl**	$C_{12}H_{10}$	**255.2**
65.	1-Methylisoquinoline	$C_{10}H_9N$	255.25
66.	2, 8-Dimethylquinoline	$C_{11}H_{11}N$	255.25
67.	7-Methylquinoline	$C_{10}H_9N$	257.60
68.	6-Methylquinoline	$C_{10}H_9N$	258.60
69.	3-Methylquinoline	$C_{10}H_9N$	259.55
70.	**2, 6-Dimethylnaphthalene**	$C_{12}H_{12}$	**260.5**
71.	2, 7-Dimethylnaphthalene	$C_{12}H_{12}$	262
72.	1, 7-Dimethylnaphthalene	$C_{12}H_{12}$	262
73.	1, 3-Dimethylisoquinoline	$C_{11}H_{11}N$	262.40
74.	1, 6-Dimethylnaphthalene	$C_{12}H_{12}$	262.5
75.	5-Methylquinoline	$C_{10}H_9N$	262.70
76.	4-Methylquinoline	$C_{10}H_9N$	264.20
77.	5-or 7-Methylisoquinoline (probable)	$C_{10}H_9N$	264.90
78.	3-Methylindole (skatole)	C_9H_9N	265
79.	1, 5-Dimethylnaphthalene	$C_{12}H_{12}$	265–265.5



THIS CHART SHOWS the compounds in straight run creosote distilling 175/450°C. and arranged according to boiling point.
Taken from pp. 1357-1370 of National Research Council Committee's book "Chemistry of Coal Utilization" (1945).

COMPOUNDS FREQUENTLY REMOVED IN PRODUCTION OF COMMERCIAL CREOSOTE THIRTY YEARS AGO

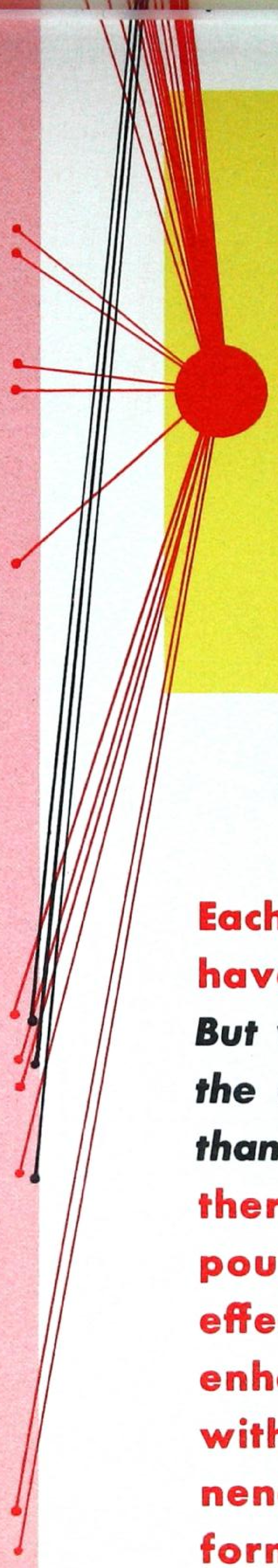
Usually called "insecticide oil" — mostly phenol, cresols, xylenols, naphthalene and tar bases. Also, at times, anthracene cake.
Taken from U.S. Bureau Mines Technical Paper 268 "Preparation and Uses of Tar and Its Simple Derivatives" (1922).

COMPOUNDS FREQUENTLY REMOVED DURING PRODUCTION OF COMMERCIAL CREOSOTE TODAY

The same "insecticide oil," but broken down into its components: coumarone, indene, phenol; o-cresol; p-cresol; m-cresol; 2, 4-xylenol; 2, 6-xylenol; 2, 5-xylenol; naphthalene; 2, 3-xylenol; 3, 5-xylenol; 3, 4-xylenol and quinoline, now sold as individual compounds.

This is made by distilling coal tar to pitch—the bulk distillate that comes off during the distillation is the creosote desired by the wood preserving industry, except that there may be too much of the more volatile or "front end" material—often too much naphthalene.

83.	1, 2-Dimethylnaphthalene	$C_{12}H_{12}$	266–267
84.	4-Methylindole	C_9H_9N	267
85.	5-Methylindole	C_9H_9N	267
86.	3-Methyldiphenyl	$C_{13}H_{12}$	269
87.	5, 8-Dimethylquinoline	$C_{11}H_{11}N$	> 270
88.	4-Methyldiphenyl	$C_{13}H_{12}$	271
89.	2-Methylindole	C_9H_9N	271–272
90.	o-Phenylphenol	$C_{12}H_{10}O$	275
91.	1, 3, 7-Trimethylnaphthalene	$C_{13}H_{14}$	280
92.	**a-Naphthol**	$C_{10}H_8O$	**280**
93.	**Acenaphthene**	$C_{12}H_{10}$	**280.7**
94.	a-Naphthofurane	$C_{12}H_8O$	282–284
95.	B-Naphthofurane	$C_{12}H_8O$	284–286
96.	2, 3, 5-Trimethylnaphthalene	$C_{13}H_{14}$	285
97.	2, 3, 6-Trimethylnaphthalene	$C_{13}H_{14}$	286.0
98.	**B-Naphthol**	$C_{10}H_8O$	**286**
99.	**Diphenylene oxide**	$C_{12}H_8O$	**287**
100.	2, 4, 6-Trimethylquinoline	$C_{12}H_{13}N$	288
101.	3, 4'-Dimethyldiphenyl	$C_{14}H_{14}$	289
102.	4, 4'-Dimethyldiphenyl	$C_{14}H_{14}$	292
103.	g-Diphenylenemethane	$C_{13}H_{10}$	295
104.	4, 5-Benzindan	$C_{13}H_{12}$	295
105.	1-Naphthonitrile (1-cyanonaphthalene)	$C_{11}H_7N$	297
106.	1-Methyldiphenylene oxide	$C_{13}H_{10}O$	298
107.	**Fluorene**	$C_{13}H_{10}$	**298**
108.	Hydroacridine	$C_{13}H_{11}N$	d. 300
109.	1-Naphthylamine	$C_{10}H_9N$	301
110.	2-Methyldiphenylene oxide	$C_{13}H_{10}O$	303–304
111.	2-Naphthonitrile (2-cyanonaphthalene)	$C_{11}H_7N$	304
112.	2-Naphthylamine	$C_{10}H_9N$	306
113.	Paraffin (octadecane)	$C_{18}H_{38}$	308
114.	Heneicosane	$C_{21}H_{44}$	310
115.	2-Methylfluorene	$C_{14}H_{12}$	318
116.	3-Methylfluorene	$C_{14}H_{12}$	318
117.	p-Phenylphenol	$C_{12}H_{10}O$	319
118.	Tricosane	$C_{23}H_{48}$	320.7
119.	Tetracosane	$C_{24}H_{50}$	324.1
120.	Pentacosane	$C_{25}H_{52}$	325
121.	Docosane	$C_{22}H_{46}$	327
122.	Nonadecane	$C_{19}H_{40}$	328
123.	Hexacosane	$C_{26}H_{54}$	330
124.	Heptacosane	$C_{27}H_{56}$	330
125.	Octacosane	$C_{28}H_{58}$	330
126.	Diphenylene sulfide	$C_{12}H_8S$	332
127.	**Phenanthrene**	$C_{14}H_{10}$	**340**
128.	Tetramethylbiphenol	$C_{16}H_{18}O_2$	341
129.	**Anthracene**	$C_{14}H_{10}$	**342.3**
130.	**Acridine**	$C_{13}H_9N$	**346**
131.	2-Hydroxybiphenylene oxide	$C_{12}H_8O_2$	348
132.	Phenanthridine	$C_{13}H_9N$	349
133.	3-Methylphenanthrene	$C_{15}H_{12}$	350
134.	**Carbazole**	$C_{12}H_9N$	**352**
135.	2-Hydroxyfluorene	$C_{13}H_{10}O$	ca. 352
136.	4, 5-Phenanthrylenemethane	$C_{15}H_{10}$	353
137.	9-Methylphenanthrene	$C_{15}H_{12}$	354–355
138.	1-Methylphenanthrene	$C_{15}H_{12}$	354–355
139.	2-Phenylnaphthalene	$C_{16}H_{12}$	357–358
140.	Hydroxyanthracene	$C_{14}H_{10}O$	d. 360
141.	Naphthacene	$C_{18}H_{12}$	360
142.	2-Methylanthracene	$C_{15}H_{12}$	360
143.	2, 7-Dimethylanthracene	$C_{16}H_{14}$	360
144.	2-Methylcarbazole	$C_{13}H_{11}N$	363
145.	1, 2, 3, 4-Tetrahydrofluoranthene	$C_{16}H_{14}$	363–365
146.	Truxene	$(C_9H_6)_2$ or $(C_9H_6)_3$	s. 364–365
147.	3-Methylcarbazole	$C_{13}H_{11}N$	365
148.	**Fluoranthene**	$C_{16}H_{10}$	**382**
149.	2, 3, 5, 6-Dibenzocoumarone	$C_{16}H_{10}O$	392–397
150.	**Pyrene**	$C_{16}H_{10}$	**393**
151.	1, 9-Benzoxanthene	$C_{16}H_{10}O$	395
152.	2-Hydroxyphenanthrene (2-phenanthrol)	$C_{14}H_{10}O$	396
153.	Retene (8-methyl-2-isopropylphenanthrene,	$C_{18}H_{18}$	396.8
154.	1, 2-Benzofluorene (naphthofluorene)	$C_{17}H_{12}$	413
155.	2, 3-Benzofluorene (isonaphthofluorene)	$C_{17}H_{12}$	415
156.	Naphtho-2', 3'-1, 2-anthracene	$C_{22}H_{14}$	424
157.	1, 2-Benzonaphthacene	$C_{22}H_{14}$	425
158.	Phenanthridone	$C_{13}H_9NO$	435
159.	Dibenzothionaphthene	$C_{16}H_{10}S$	ca. 440
160.	Sulfur	S	444.6
161.	Chrysene	$C_{18}H_{12}$	448.5
162.	Triphenylene	$C_{18}H_{12}$	450



27 SELECTED COMPOUNDS TESTED AND PROVED TO BE FUNGI-TOXIC IN CREOSOTE

Full details of this research are shown in chart on page 5. Remember, there are over fifty *tested* fungi toxic compounds in creosote. This graph represents the results of just one test run by reliable authorities.

Each tested compound was found to have a definite toxicity toward fungi. *But when two compounds were mixed, the effect on the fungi was far greater than each of the compounds alone.* It is therefore the great multiplicity of compounds in creosote, their individual effectiveness toward fungi, plus their enhanced effectiveness in admixture with one another and their permanence that is responsible for the performance of creosote.

A line of pressure-creosoted pine poles in Staten Island, N. Y., erected in 1900. Recent inspection showed them to be in condition to give service for many years to come, although they are now 52 years old!

What is the life expectancy of wood treated with CREOSOTE?

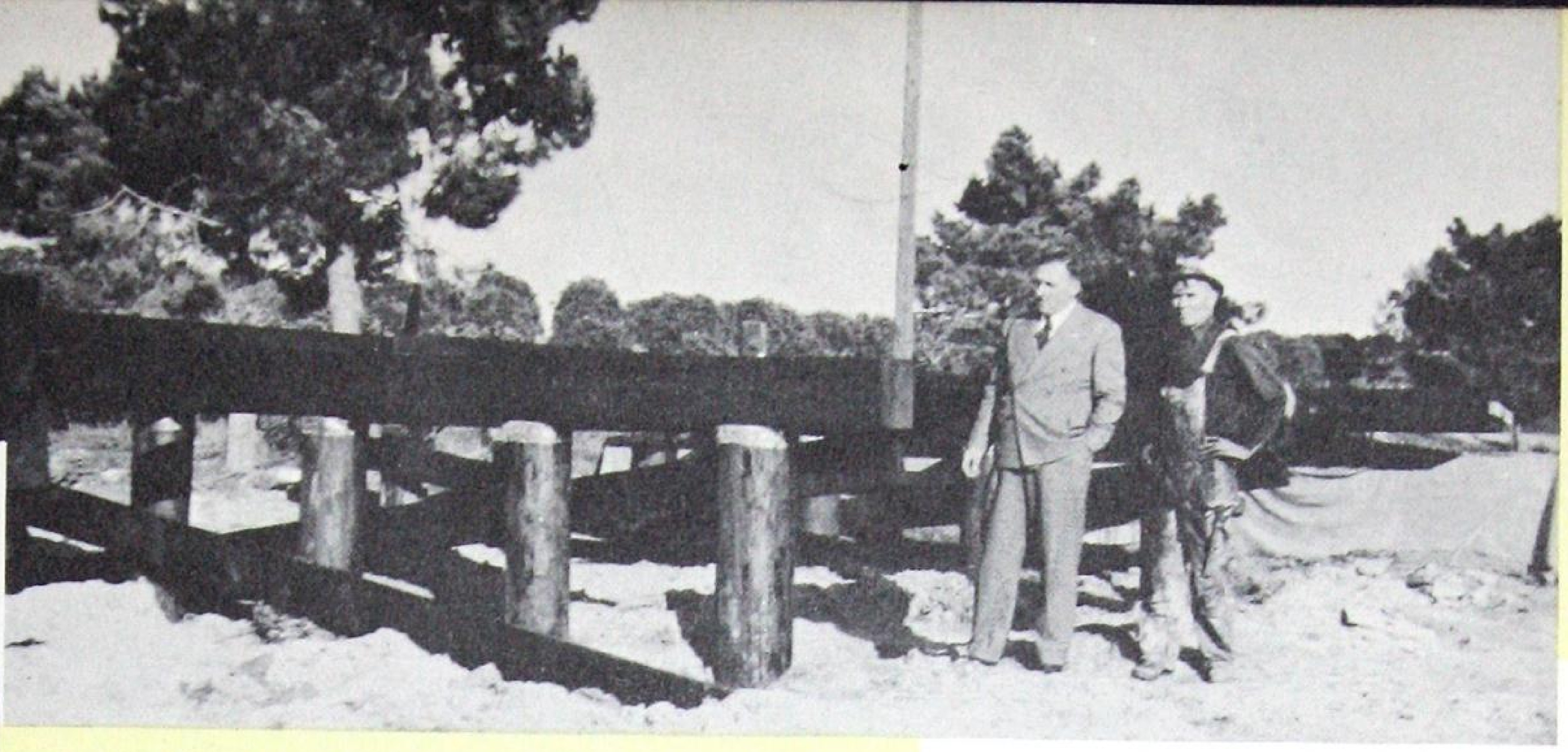
Let's let the record speak for itself.

Many tests have been made which clearly demonstrate the superiority of pressure-creosoted wood for poles and railroad ties. Probably the most convincing proof is what the railroads generally do about ties. They have tried many substances, starting back in the 1800's, and have now standardized nearly 100% on pressure-creosoted ties for permanent trackage. No one company could accumulate such experience. It is easy to realize that the hard facts of long life and lower yearly cost have dictated the railroads' choice of pressure-creosoted wood.

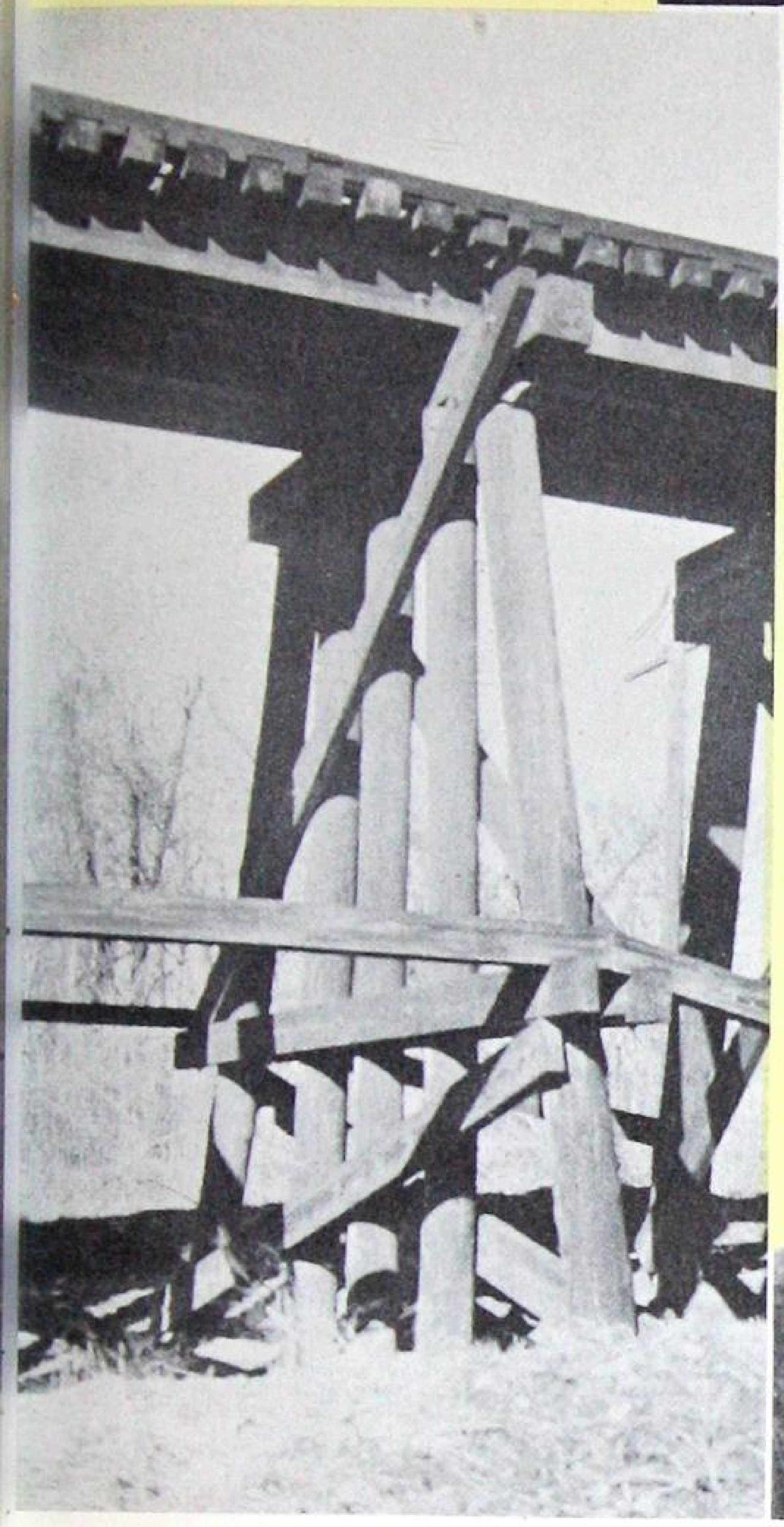
The Santa Fe Railroad set some pressure-creosoted fence posts in 1913. Thirty-four years later, *all* were still in service. Untreated posts failed in the same location in four years.

A few years ago, the Post Office Department in England computed that they had over 8,000 creosoted poles still in service 70 years after erection.

Some of the 35 year old creosoted timber removed from the Vancouver, B. C. Broadway bridge of the Great Northern Railroad during its reconstruction. Salvaged lumber was stored for further use.



Creosoted piling which was in a Santa Monica, Calif. pier for 57 years was salvaged at wrecking of pier. Much of it is now in use elsewhere, supporting culverts and short bridges.

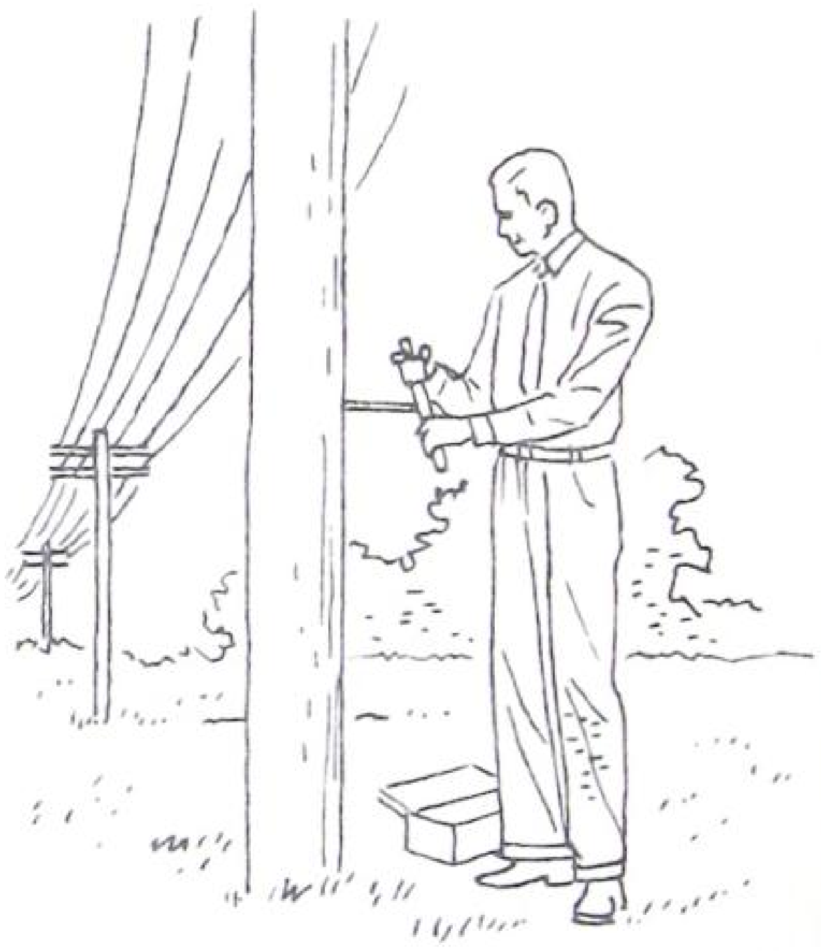


One of the open deck trestles erected 41 years ago on the lines of the Kansas City and Southern Railway. Its creosoted timber is still in condition for many more years of service.

This 32 year old ballast deck railroad bridge was built of creosoted Southern Pine piles and timbers.

The American Wood Preservers Association has in its files carefully compiled records on length of service for pressure-creosoted Southern Pine poles. Of an original 16,793 poles on record as being treated with creosote, after an average of 25.4 years, 92.3% of the poles (15,494) were still entirely sound. Serviceable yet, but showing signs of decay were 427 poles or 2.5% of the total. And, in this instance, as well as in the 5.2% of poles removed from the original 16,793 because of decay, the failure was *not* due to creosote's quality as a preservative. The poles had not been properly treated with the minimum specified amounts of creosote in those areas of failure.

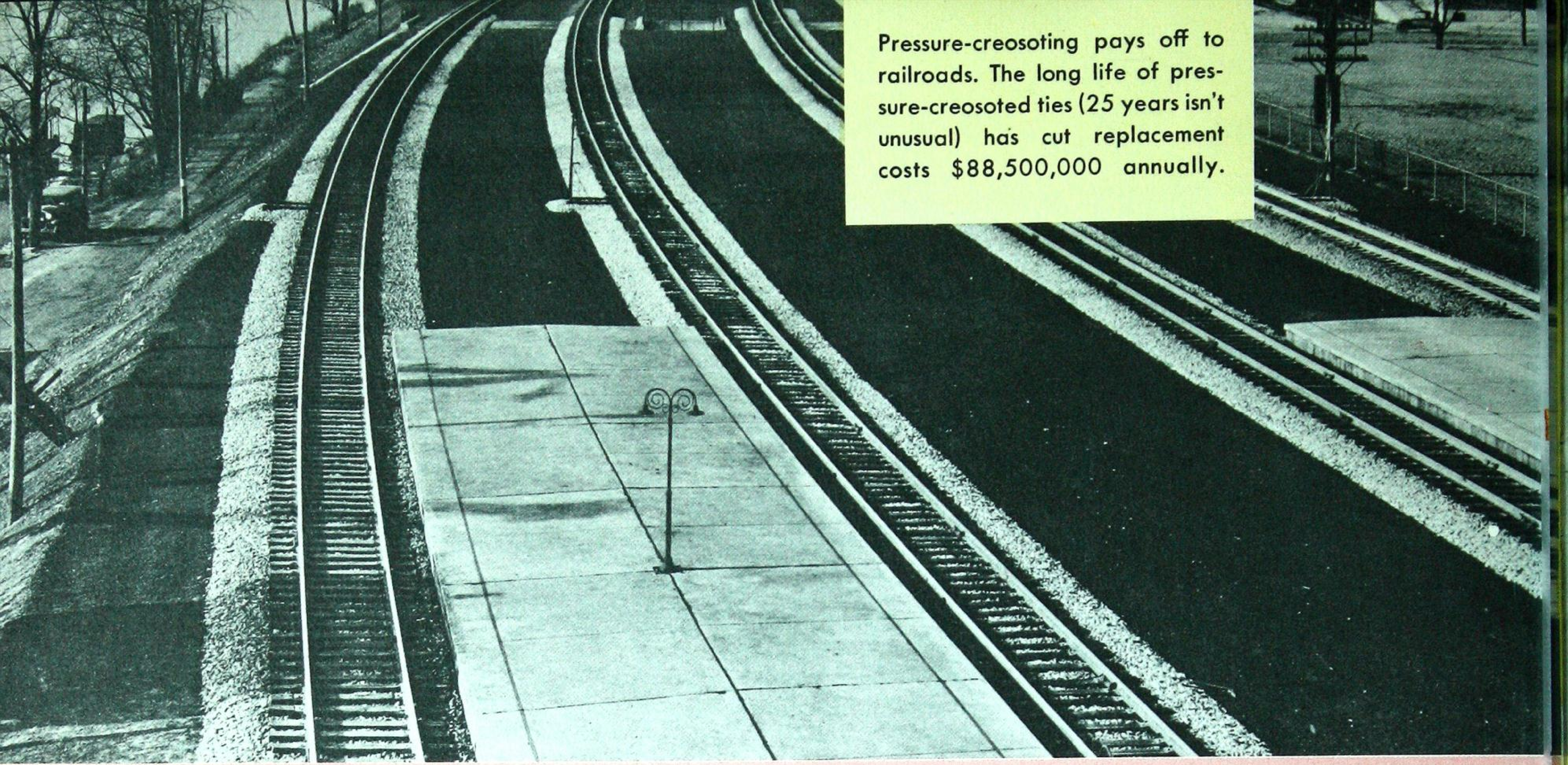
Research by Bell Telephone Laboratories shows there is no decay hazard for at least 26 years in individual pine poles having the minimum penetration of creosote on AWPA specifications. The average *expected* life should be well in excess of 30 years . . . and up to 40 or 50 years.



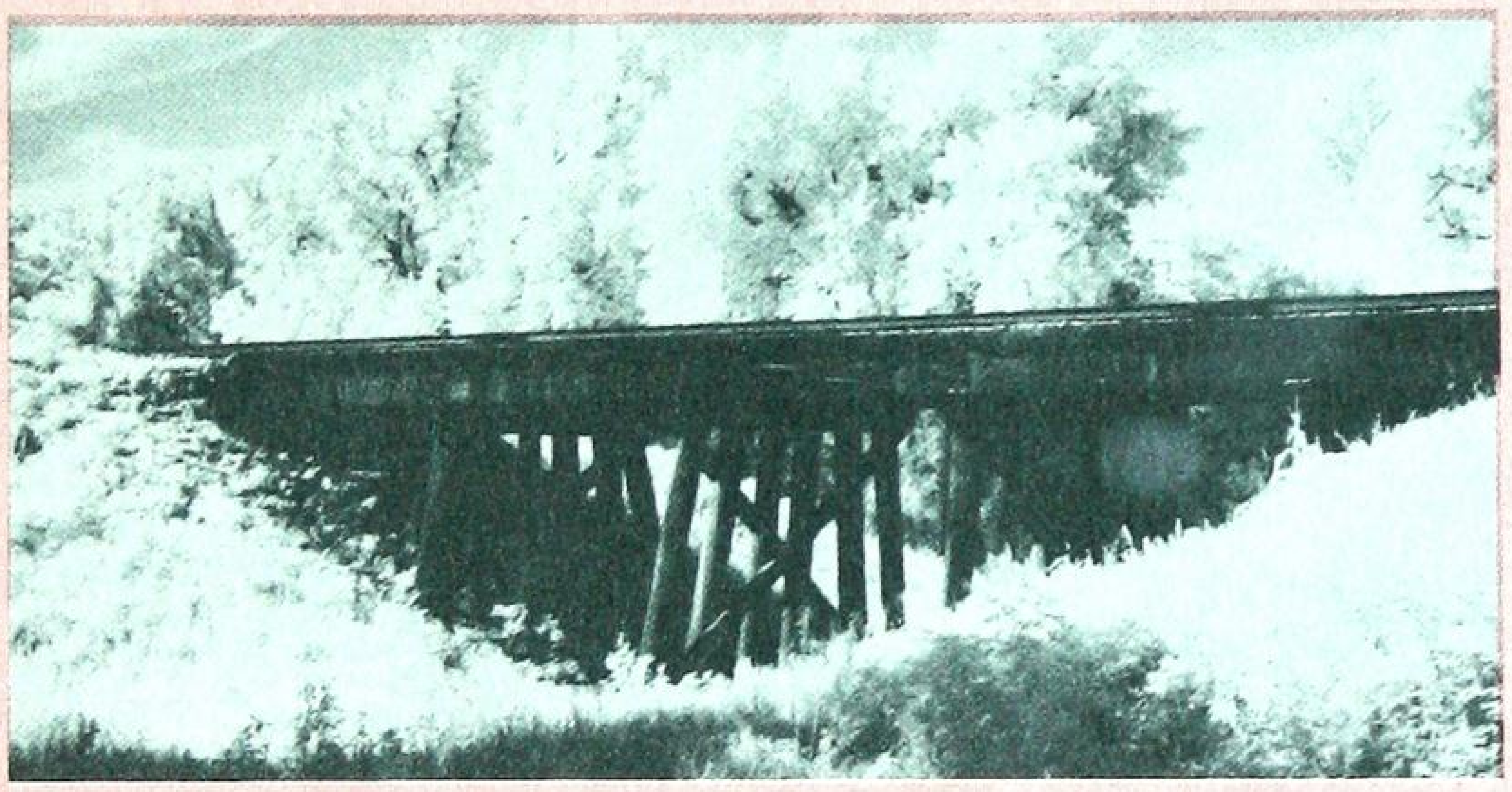
The examples cited here are the rule rather than the exception. Pressure-creosoted wood has withstood the acid test of years and years of actual use — in all types of soil and climate. Creosote has a *proved* record for preserving wood.

Other specific examples of longevity are illustrated on these pages. These are typical of the protection offered by pressure-creosoting. Hundreds more are reported to the American Wood Preserving Association and remain on record in their files.

THERE IS NO GUESSING OR THEORIZING ON SERVICE LIFE OF WOOD WHEN CREOSOTE IS USED!

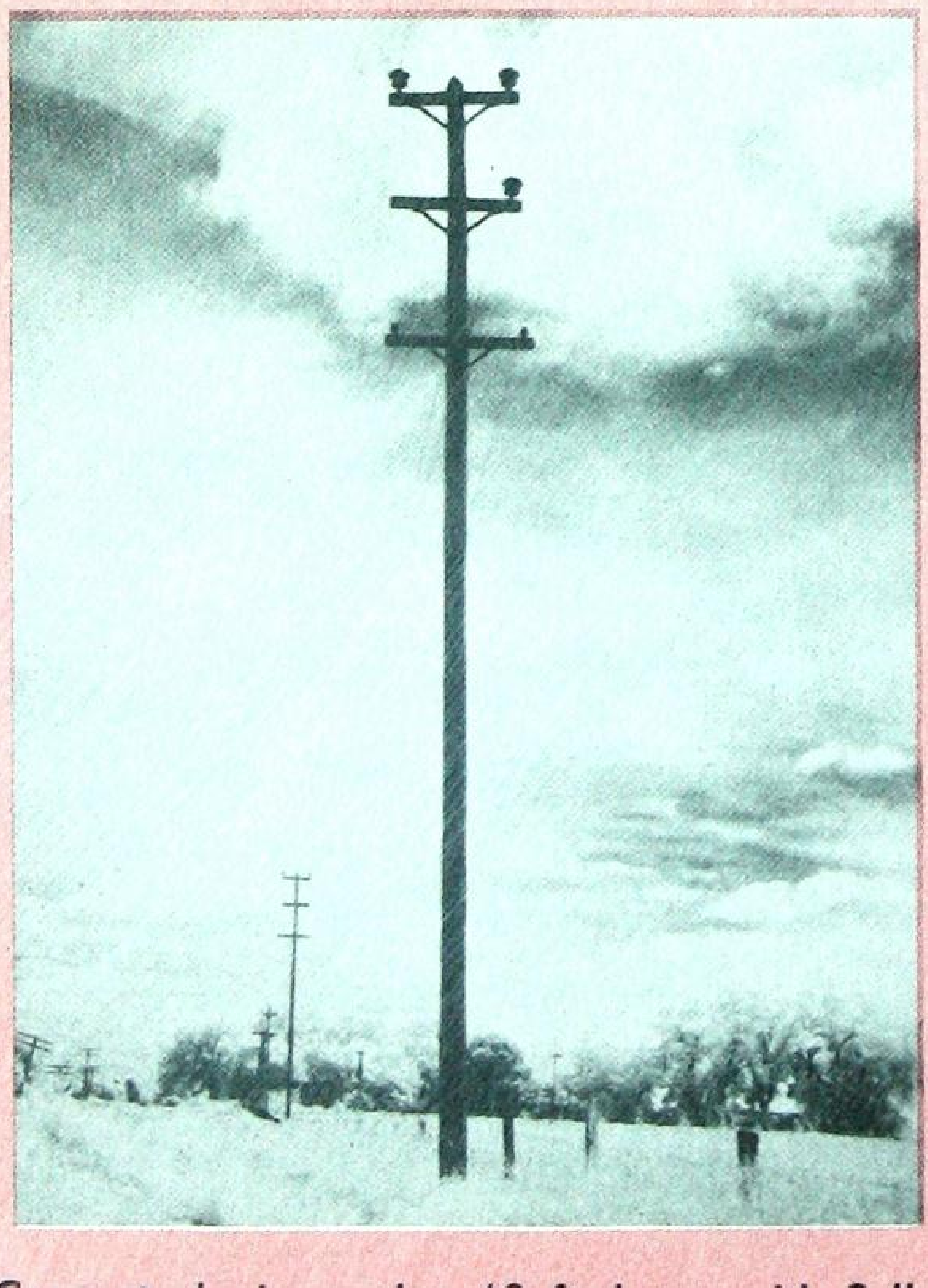


Pressure-creosoting pays off to railroads. The long life of pressure-creosoted ties (25 years isn't unusual) has cut replacement costs $88,500,000 annually.

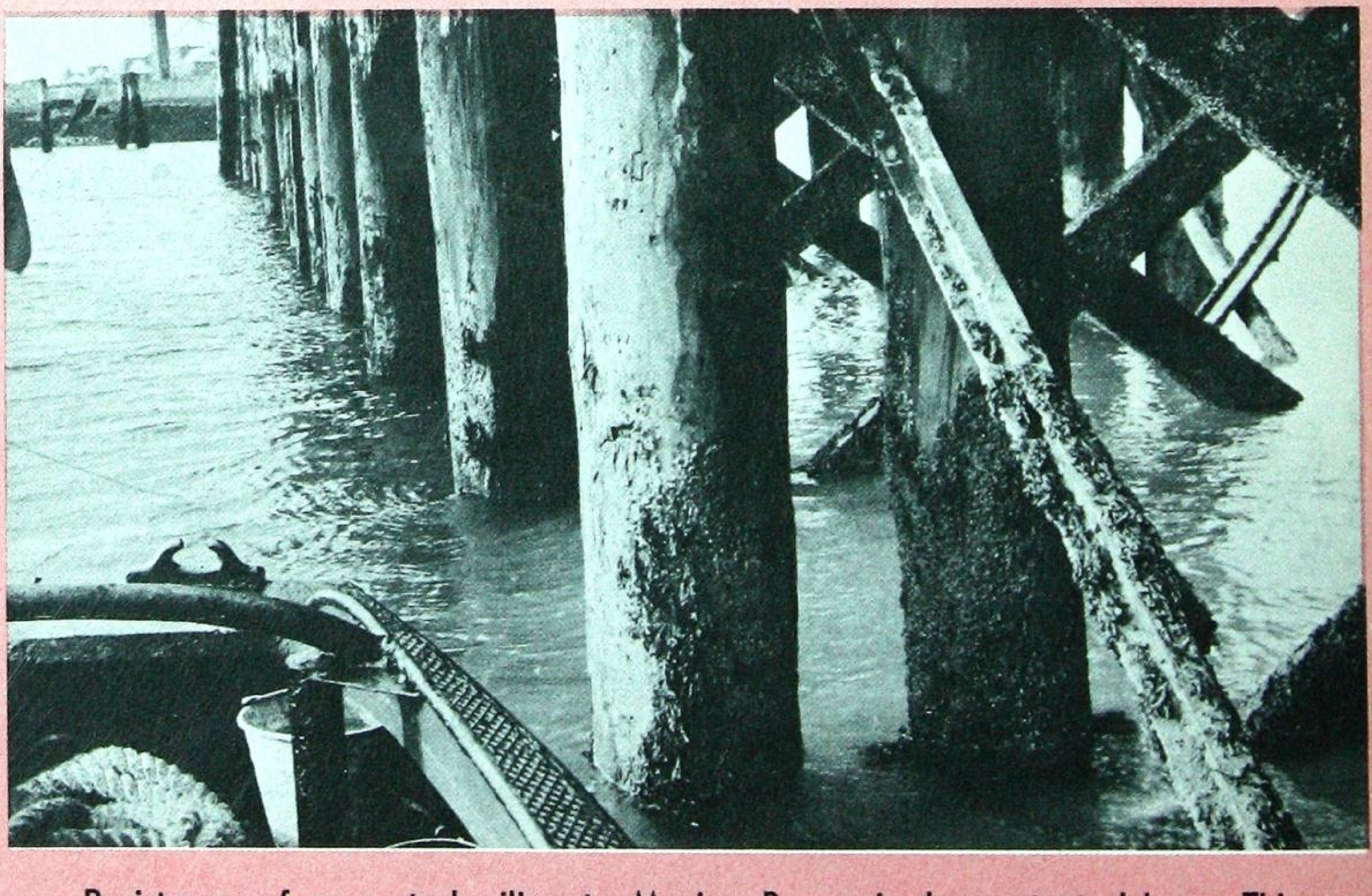


Creosoted timber bridge near Joplin, Mo. erected 34 years ago. No repairs have been necessary to date.

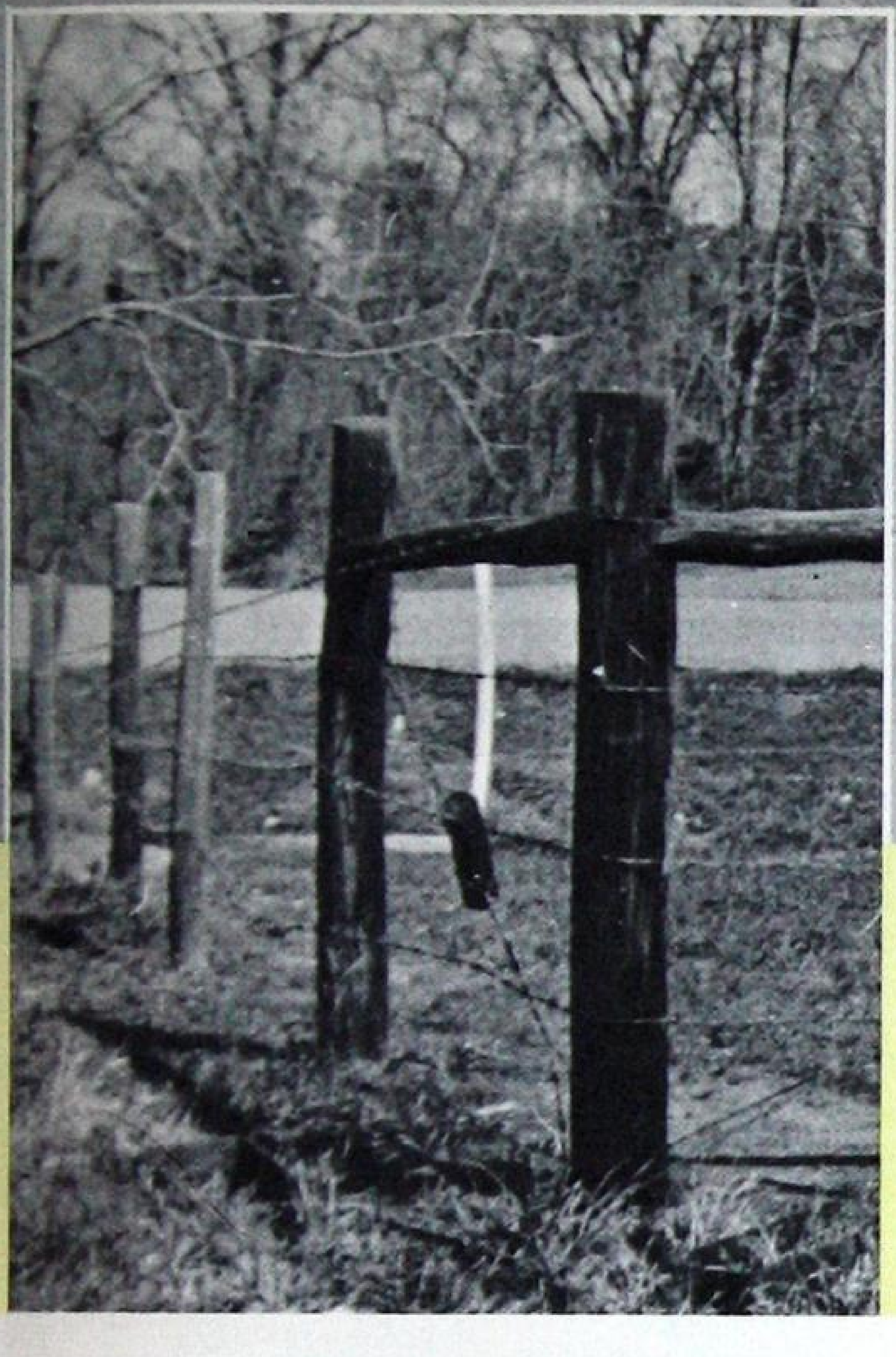
A line of pressure-creosoted Southern Pine poles installed in 1915 near Gypsum, Kansas was lifted 15 years later and moved to another location. Recent inspection after heavy floods showed that all were intact and ready for additional years of service.



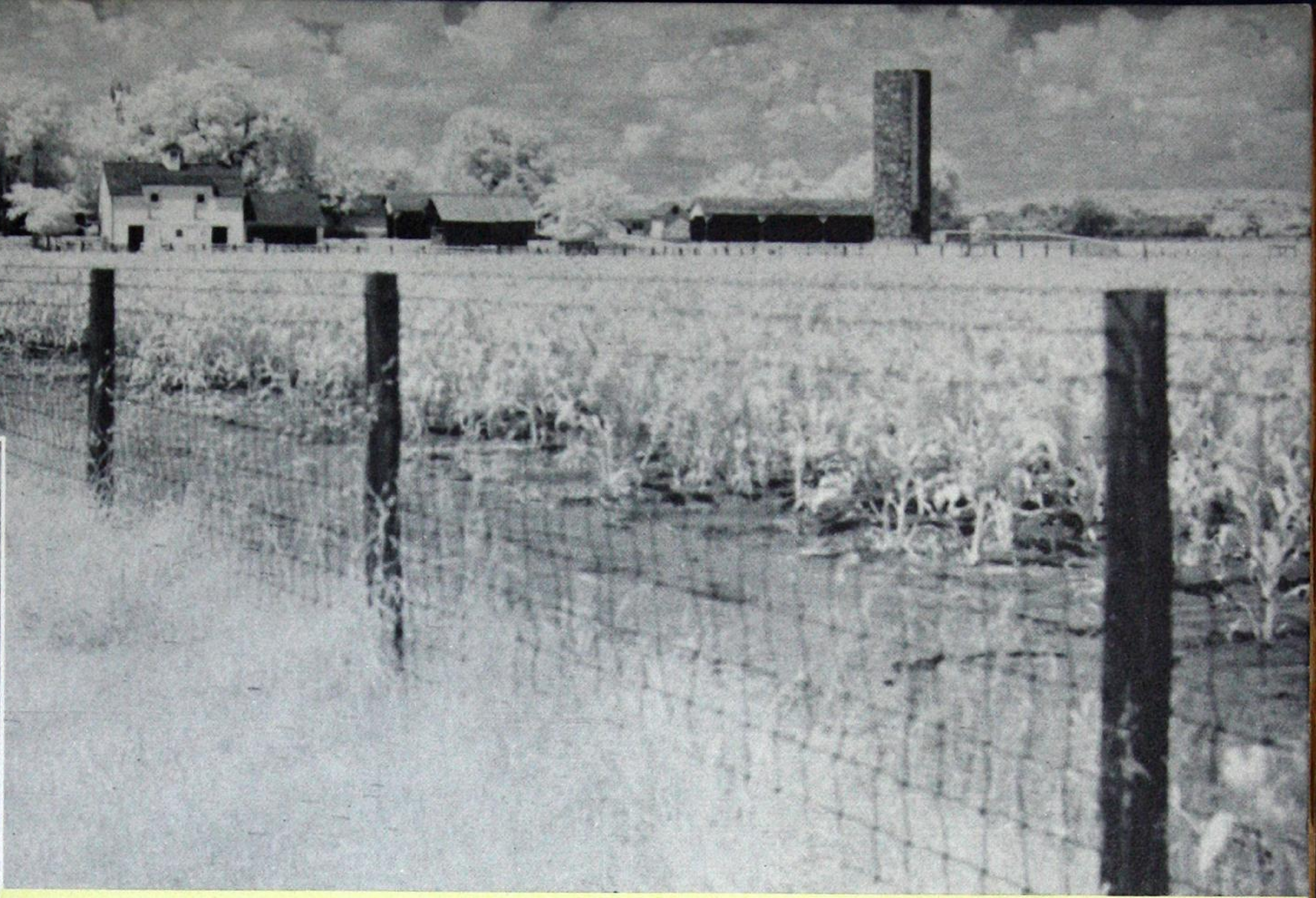
Creosoted pine poles 40 ft. long, with 8 lb. empty-cell treatment in line built in 1926 by a Nebraska public utility company.



Resistance of creosoted piling to Marine Borers is demonstrated here. This pine piling is pictured after 20 years' service at the end of a jetty near Wilhelmshaven, Germany. Untreated piles driven at same time were completely destroyed by the borers.



Section of a fence put in by an Alabama farmer in 1928. Twenty-two years later, when these creosoted posts were removed to widen a road, only one post of the entire line could not be re-used in the new fence.



A farmer in the Midwest installed this line of four-inch round pressure-creosoted posts 17 years ago. They're in perfect condition today.

A word about costs...

TO THE USERS OF CREOSOTE TREATED WOOD

Pressure-creosoted wood costs you less per year of use! The initial cost of pressure-creosoted poles, posts, ties or other lumber, when pro-rated over their active service life, will average out lower than wood treated with any other proved preservatives. With the high cost of labor today, you can't afford to take chances on wood treated with new, unproved preservatives. It may cost you a great deal in time and money for replacements because the unproved preservative may fail to give protection over the same long period which use of pressure-creosote treatment assures.

Each service year you do not get from wood treated with other preservatives — but that you *know* you've been getting from creosoted wood — is an unnecessary financial loss!

CREOSOTE protects wood today every bit as well as years ago . . . it is still the best wood preservative known!

94% OF ALL WOOD PRESERVED TODAY IS PRESERVED WITH CREOSOTE!

KOPPERS COMPANY, INC.

TAR PRODUCTS DIVISION
PITTSBURGH 19, PA.

For additional information, contact our nearest district sales office.

DISTRICT OFFICES

SOUTHERN:	WOODWARD, ALABAMA	Birmingham 58-1611
MIDWESTERN:	CHICAGO 3, ILL., 122 S. MICHIGAN AVE.	Webster 9-2400
EASTERN:	NEW YORK 1, N. Y., 350 FIFTH AVE.	Longacre 4-1130
NEW ENGLAND:	BOSTON 16, MASS., 250 STUART ST.	Hancock 6-1700
PACIFIC:	LOS ANGELES 1, CALIF., 729 E. GAGE AVE.	Adams 3-6231
PITTSBURGH:	PITTSBURGH 19, PA., KOPPERS BLDG.	Atlantic 1-6240

PRINTED IN U.S.A.

Form No.